Energy Saving Drive Solution
LS Medium Voltage Drive

LSMV-M1000/M1000A

3kV 200kVA~3,700kVA
4kV 250kVA~4,700kVA
6kV 400kVA~7,500kVA
10kV 600kVA~11,000kVA
11kV 660kVA~12,500kVA

LS IS

Leading You Toward a Greater Future Than You Imagine

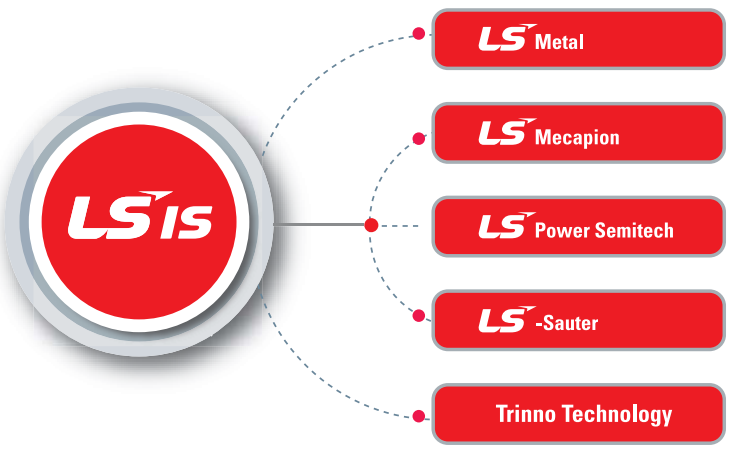
Leaping Beyond Being Korea's No.1 into a Global Top Company in Industrial Electric / Electronic Solutions / Materials & Energy Sectors

Greater Value Together LS

LS Group, a leader of the electric/electronic and energy sectors began as a LG Group's spin-off in 2003.
LS Group is growing again into an organization delivering the best quality and excellent product development insight, and customer-centric total solution packages. Company's mission of becoming the global leader in the industry is to find the reason for its existence in standing and rising together with its customers.

Innovator of Power Solutions & Automation Systems

LSIS, a global leader in industrial automation systems and power solutions, provides customers with total solutions. LSIS is building win-win relationships with power transmission/distribution, electric power devices, automation systems, and smart-grid customers with future-oriented technologies and environment-friendly products that maximize energy efficiency.



OVERVIEW

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LSIS Leads You to the Advanced Industry!

Optimum MV Drive Solution for Industrial Plants & SOC Systems

LSIS medium voltage drive consists of compact integrated systems built on cutting-edge technologies, delivering optimum energy-saving solution featuring high efficiency and power factor. The system supports a user-friendly HMI(Human Machine Interface) that allows easy operation and displays desired information for customers maximum convenience. LSIS medium voltage drive offers leading industrial drive solutions with proven reliability and economic viability. It also contributes to energy saving and environment protection in various industries including gas, water treatment, marine, power generation, and cement.

LSMV-M1000

LSMV-M1000A

Energy Saving Drive Solution
LS Medium Voltage Drive

LSMV-M1000/M1000A

Customized Solutions for Various Industrial Sectors

LSIS' medium voltage drive offers customized solutions incorporating customer requirements and drawing upon its proven reliability in various industrial sectors.

Series Overview

MV Drive Series	LSMV-M1000	LSMV-M1000A
Voltage	3kV/4kV/6kV/10kV/11kV	3kV/6kV
Capacity	200kVA~12,500kVA	200kVA~1,200kVA
Control Mode	V/F, Sensorless Vector	
IP Class	Standard IP21 (~IP42 Optional)	
Standards	CE, UL(Pending)	
Frequency	50/60Hz	
Topology	Multi-Level PWM	

Major Application Domains

Oil & Gas
- Electric submersible pump
- Reciprocating/Centrifugal compressor
- Conveyor
- Unloading & booster pump

Water Treatment
- Inlet/outlet pump
- Auxiliary pump
- Defoaming pump
- Booster pump

Power Generation
- Boiler feed-water pump
- Condensation pump
- Cooling water pump
- District heating water circulation pump
- Primary and secondary air fan
- Coal mill and conveyor

Metal
- Furnace fan
- Fluid transfer pump
- Conveyor
- Sludge pump
- Quenching pump

Marine
- Thrusters
- Conveyor
- Vessel propulsion
- Pump

Chemical & Plastic
- Extruder
- Mixers
- Coker & wet-gas compressors
- Stirring machine
- Heat exchanger pump

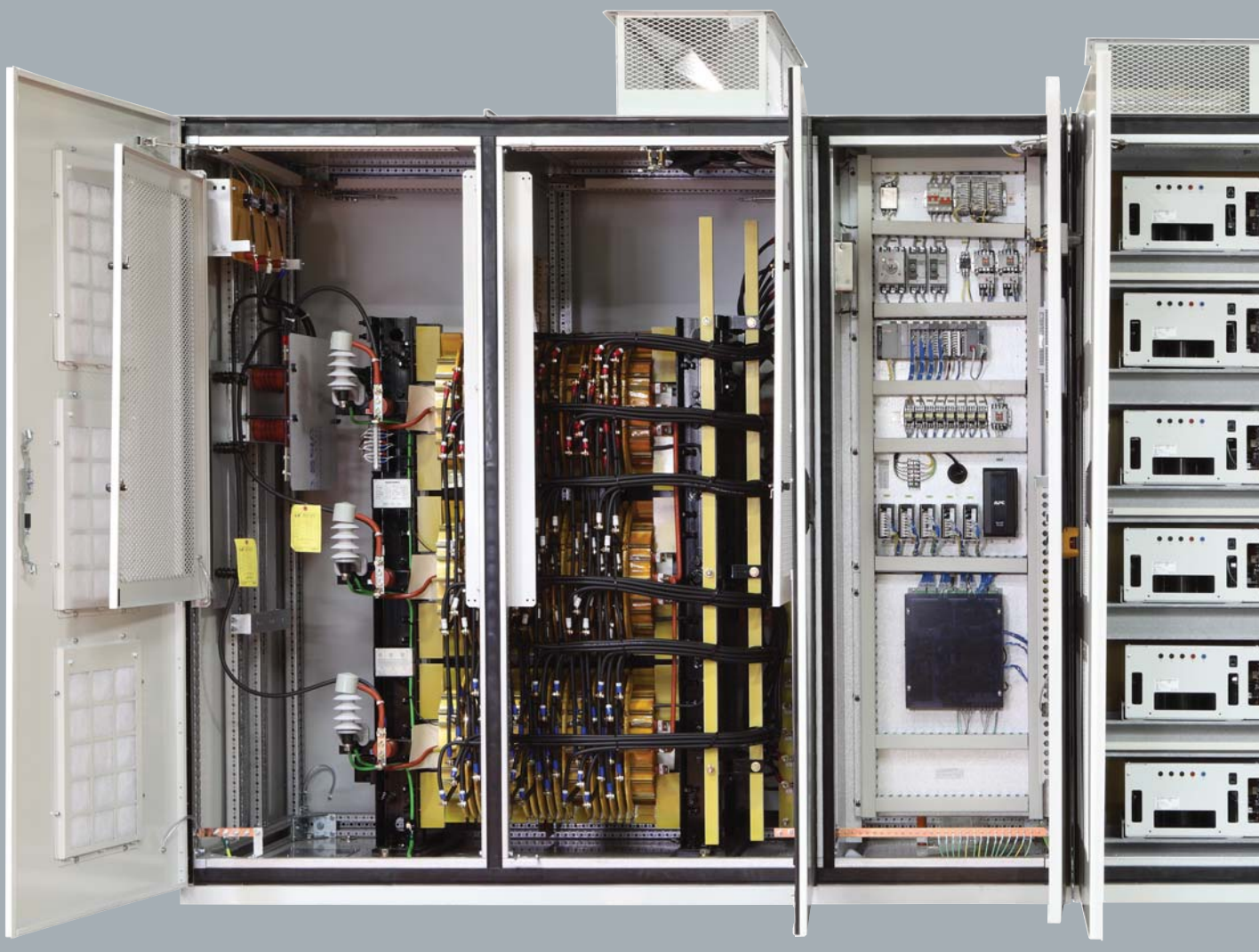
Cement
- Kilns
- Cement mills
- Raw mills
- Crushers
- Exhaust fans
- Main & auxiliary fans

Paper-making
- Boiler fans
- Chippers
- Auxiliary pumps
- Chip refiners
- Vacuum pump

Energy Saving Drive Solution
LS Medium Voltage Drive **LSMV-M1000A** Series

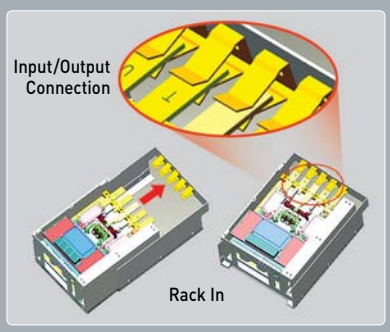
COMPACT DESIGN

Minimizing Installation Footprint and Investment Costs by an Optimized Drive Design



Front-access Maintenance

The rack-in type is constructed with a simplified cell, allowing users to access the drive from the front for maintenance. This eliminates need for additional space in the rear reducing the product installation footprint.



Low-noise Fan

M1000A product uses a fan that has a drastically reduced noise level, supporting 0~10V speed control through its built-in PID control.

BENEFIT

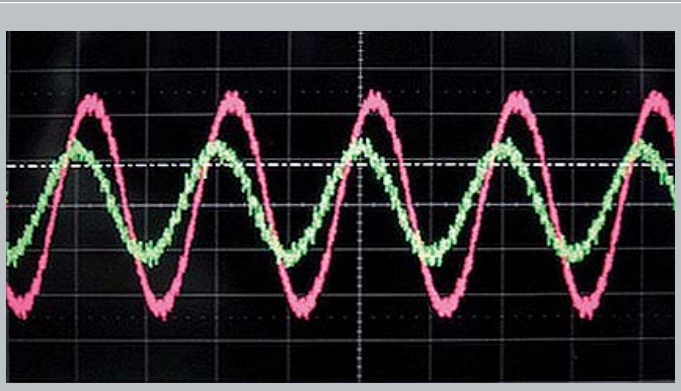
Energy Saving through Efficient Energy Management

LSIS' medium voltage drive demonstrates a unique compact system built upon optimal design. It is easy to install and constructed to not require input/output filters, offering high efficiency and energy saving benefits.

Improved Power Quality

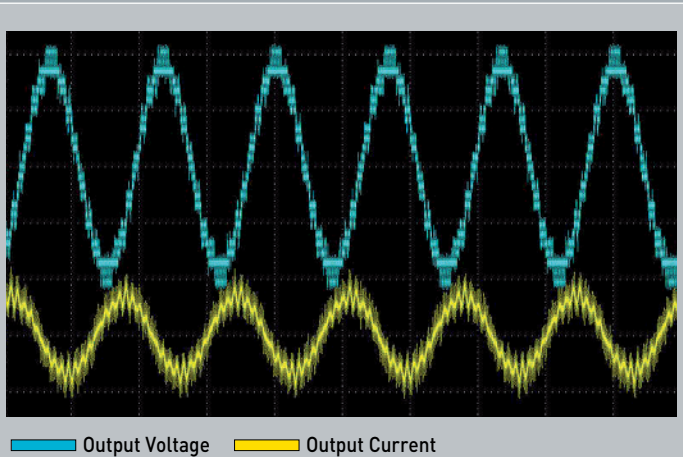
Improved Input Power Quality and THD (Total Harmonic Distortion) by Adopting Multi-winding Phase-shift Transformer

- Application of extended delta-type transformer and separated-type multi-pulse rectifier drastically reduces input power THD, hence complying with IEEE-519 standard.
- Input current almost identical to sine waves eliminates need for additional harmonic filters or active filters on the input side.



Producing Multilevel PWM-type Sinusoidal Output

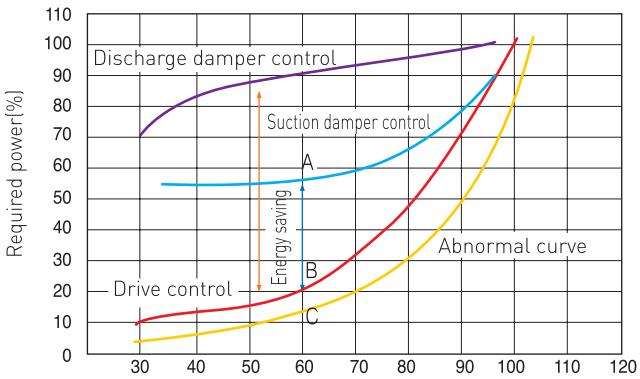
- Compatible with conventional motors and cables to ensure it fits in with existing system design
- Minimal impact of voltage reflection, allowing longer cable length between drive and motor
- Medium voltage drives minimize mechanical stress on motor, eliminating need for additional sine wave filters.



BENEFIT

Energy Saving

Achieving Energy Saving and Minimum Energy Loss through Optimized Speed Control



[Fan operation characteristics Ex.)
Wind volume, revolution speed, power requirement characteristics]

Energy Saving

The optimum way to save energy from fans, pumps, and blowers is to control the motor speed with drive. This is far more effective in energy saving than fluid control by damper.

Example of Operating Conditions

(1) Motor in use: 3300V, 600kW, 6P (Motor efficiency: 95%)

(2) Operating at 60% of air flow volume (Motor efficiency of 90% at 100% of flow volume)

1. Inlet-side Damper Control Power (A)

$$600 \times 0.55 \times \frac{1}{0.95}_{\text{Motor Efficiency}} = 347.4kW \cdots (1)$$

Note) 0.55: Power rate required for damper's suction control when operating at 60% of air flow volume

2. Drive Control Power

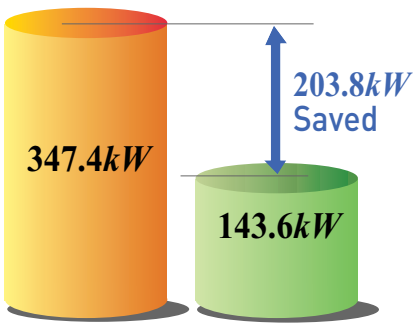
Rated Motor Output (C) $600 \times (0.6)^3 = 129.6kW \cdots\cdots (1)$

Motor Input Power $129.6 \times \frac{1}{0.95}_{\text{Motor Efficiency}} = 136.4kW$

Drive Input Power(B) $136.4 \times \frac{1}{0.95}_{\text{Drive Efficiency}} = 143.6kW \cdots\cdots (2)$

3. Energy Saving

Drive-enabled annual energy saving [(1)-(2)]



$(347.4\text{-}143.6)kW \times 8{,}000h = 1{,}630{,}400kWh$

(Assuming 8,000 hours annual operating time)

The electricity bill that can be saved per year assuming an electric power tariff of KRW55/kW

$1{,}630{,}400 \times 55 = \$\ 81{,}520$

Increasing Facility Efficiency

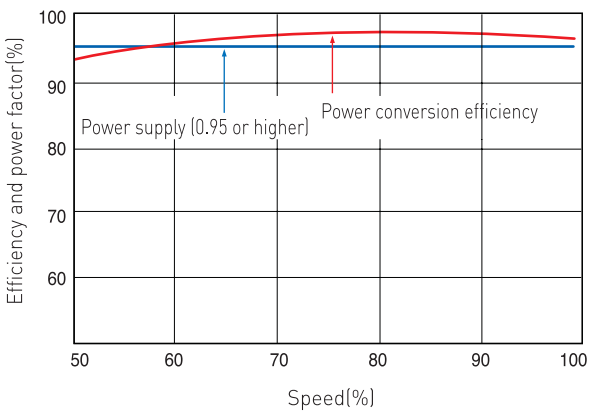
Improving the Productivity with Optimized Facility Operation Ratio

- Effective process control through prompt and flexible speed control in response to change operating environment and demand
- Improving productivity and product quality with optimized facility operation ratio.

Reducing Operation and Maintenance Costs

- Soft starting eliminates network instability and process risks from starting current and voltage drop.
- Reducing maintenance frequency and costs with decreased motor stress and extended equipment service life.

Guaranteeing High Operating Efficiency and Power Factor



Power Conversion Efficiency Ratio

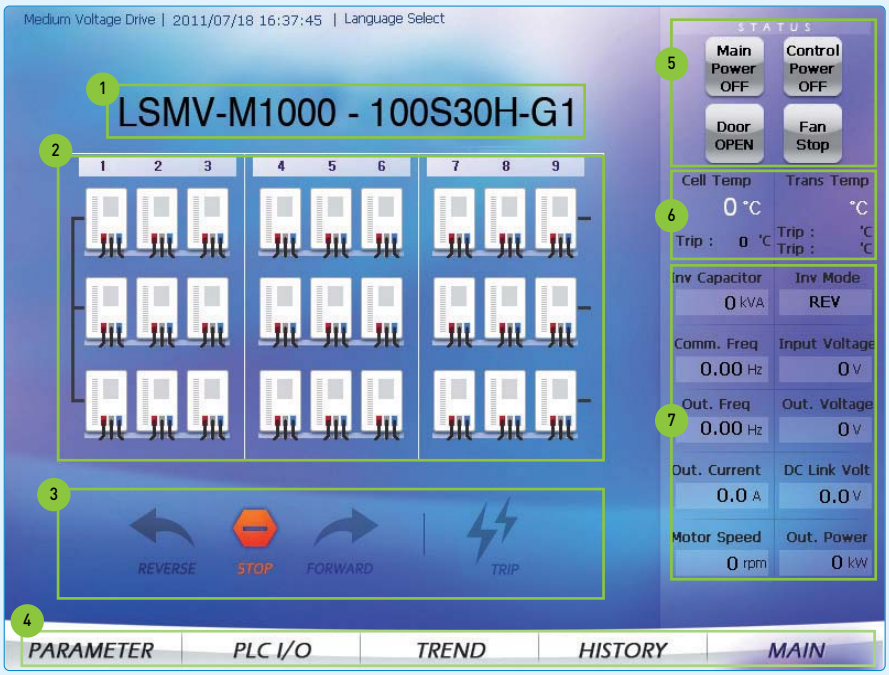
- Delivering a high power factor at 95% or above with an independent built-in system without additional power factor corrector
- Improving system efficiency with a drive-only system configuration without input/output filters

BENEFIT

User Convenience

Monitoring (HMI)

Standard HD HMI Monitoring Maximizes User Convenience



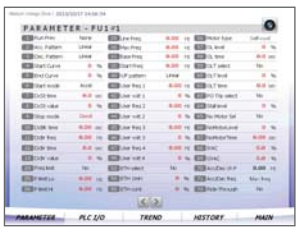
- 12.1 inch touch screen
- Supporting multi languages (Korean, English, Chinese, Russian, Spanish, Thai, and Portuguese)
- Control and system state monitoring
- Powerful data control (data logging, diagnostics, and information)
- User-centric convenience (HD display, high data throughput, user-friendly interface)
- Supporting dedicated editor for changing display items(Optional).

1. MVD Model Name
2. Cell Mode
3. MVD Operation
4. Menu Selection
5. Power/Fan
6. Temperature Display
7. MVD Mode

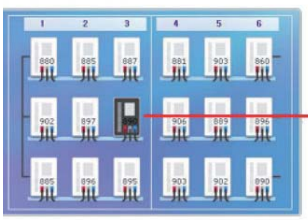
External Interface

Ethernet I/F | Serial I/F (RS-232C) | Serial I/F (RS422/485) | USB I/F | CF card I/F | Extension port

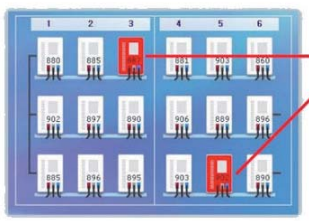
History


Parameter

Trend



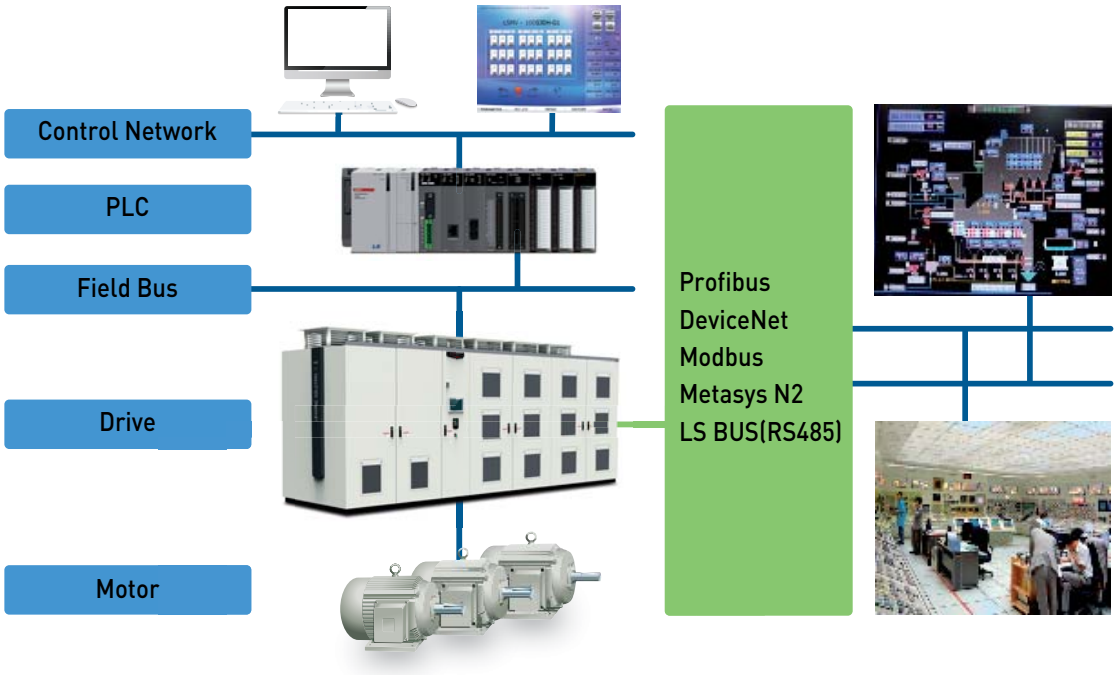
V2Cell is in Bypass Mode



U3 and W5 Cells are in Failure Mode

Communication

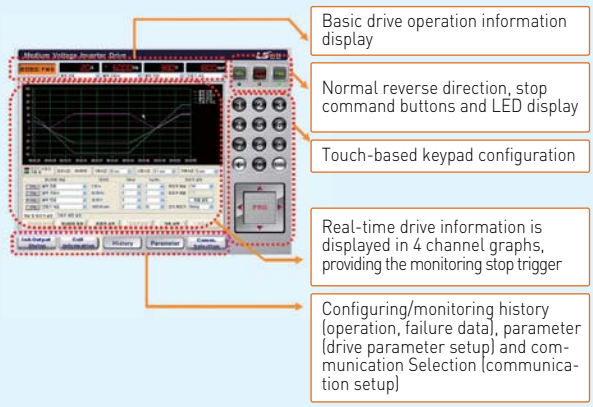
- Standard built-in PLC supports customization (I/O extensibility, etc.)
- Providing the improved system compatibility with field-bus communication options



Monitoring

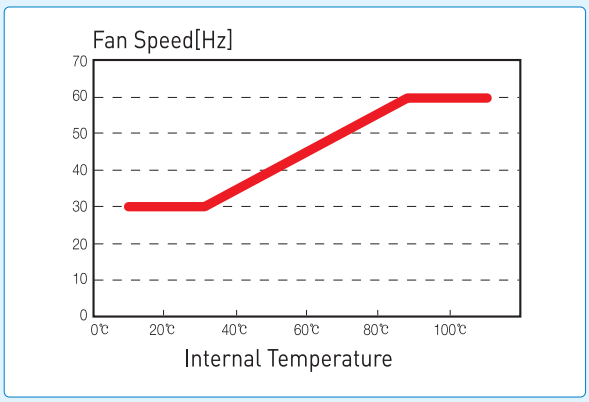
MV System View (Option)

- MV System View is a PC (Windows XP and Window 7 - compatible)-based software that uses RS485/232 communication links between MVD and PC to control/ monitor MVD.
- Communication standards and a built-in system view enables flexible application in various systems. It facilitates remote operation and operating state monitoring by higher-level systems.


Basic drive operation information display
Normal reverse direction, stop command buttons and LED display
Touch-based keypad configuration
Real-time drive information is displayed in 4 channel graphs, providing the monitoring stop trigger
Configuring/monitoring history (operation, failure data), parameter (drive parameter setup) and communication Selection (communication setup)

Optimized PID Control of Cooling Fan According to Heat Release

Reducing fan noise, power consumption and extending fan service life by optimizing cooling fan speed control in proportion to the drive internal temperature



FUNCTION

Improving Reliability through Various Control Functions

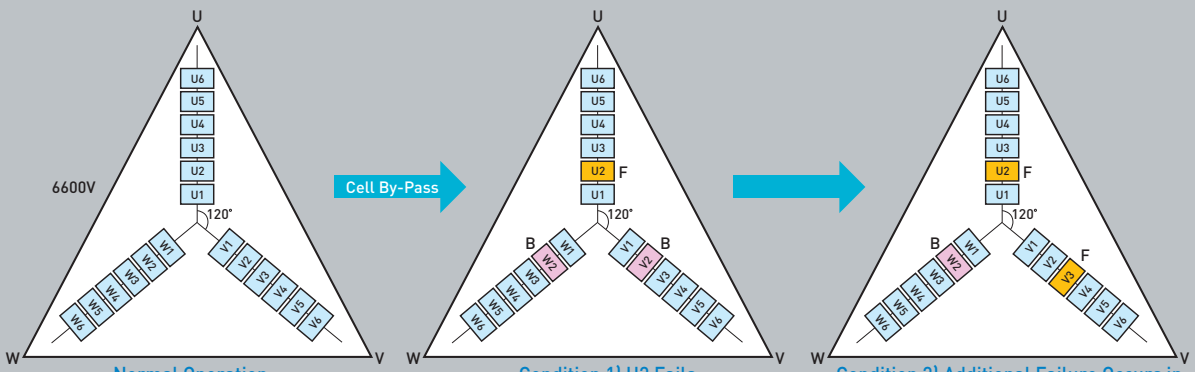
LSIS's medium voltage drives offer highly reliable optimum solutions by providing sensorless vector control, flying start, ride-through, and many more functions.

Cell Bypass Function

Automatically bypass of failed cells if cells connected in series randomly fail during operation, allowing continuous operation.

Operate Cell Bypass Function (In Auto Setup)

- F : Bypass following cell failure
- B : Auto bypass



Normal Operation

Condition 1) U2 Fails
Restart after automatic bypass of V2/W2

Condition 2) Additional Failure Occurs in V/W Phase Excluding U Phase
V2 Bypassed at discretion is returned to normal mode

Flying Start

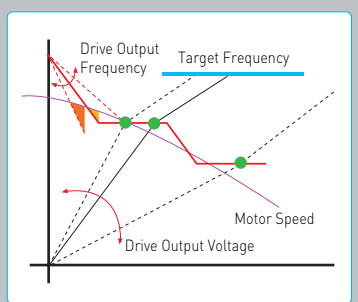
Automatically estimates speed of the rotating motor to reach the frequency without any system failure(trip)

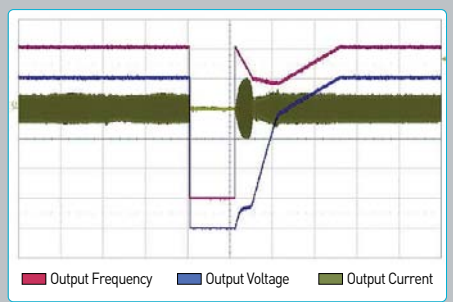
Example of Flaying Start

- Select flying start at the same time as power application
- Reset after trip
- Automatic restart
- Restart after ride-through

Quick Speed Estimation

- Reduce speed estimation time by controlling the drive output frequency speed reduction
- Reduce estimation time by reducing output frequency
- Reducing estimation time by controlling voltage response





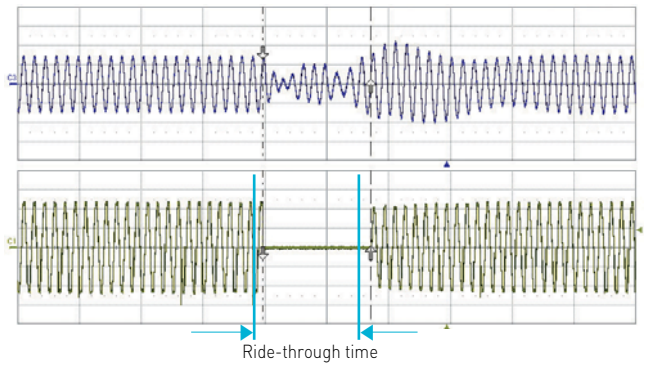
FUNCTION

Ride-through Capability

Mechanical energy of load is regenerated to continue operation for up to 5 cycles when power outage occurs. It allows continuous operation without stopping the drive or system.

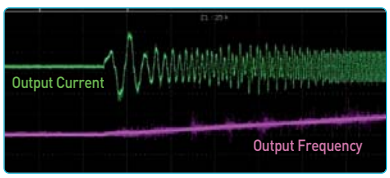
Improving Power Quality and Reducing Industrial Damage

- Unpredictability
- Irregularity
- Response to force majeure events



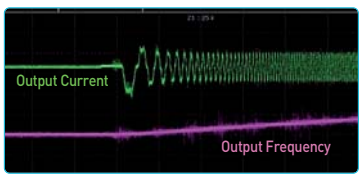
Anti-current Hunt Algorithm in Resonance Area

Continuous drive operation possible in the resonant area followed by application of the drive



Residual area avoidance function not applied

Residual current hunting makes continuous operation not possible



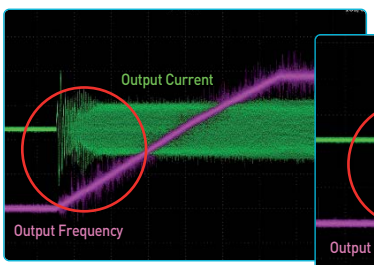
Resonant area avoidance function applied

Continuous operation possible in spite of residual current hunting

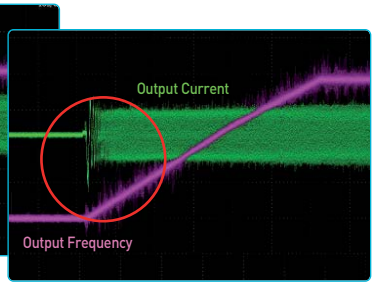
Sensorless Vector Function

Improved Starting Torque and Accurate Torque Control

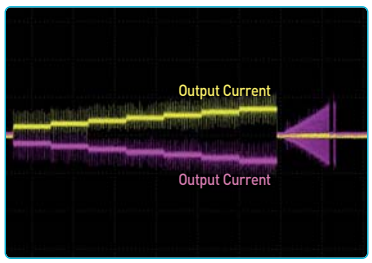
Powerful sensorless algorithm improves speed and torque control precision in low-speed area



V/F control



Sensorless vector control

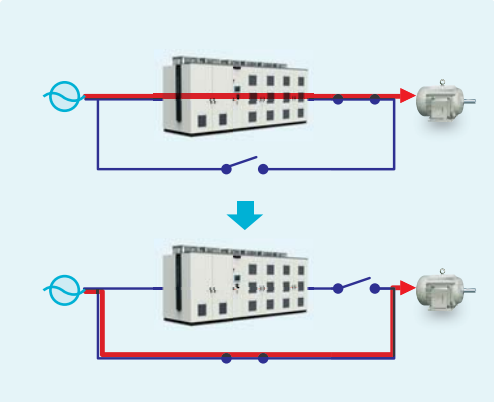


Auto-tuning function

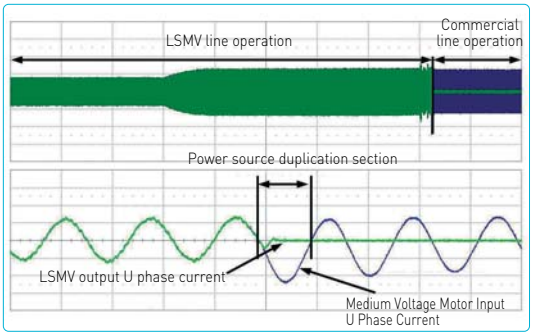
Synchronous Transfer Function

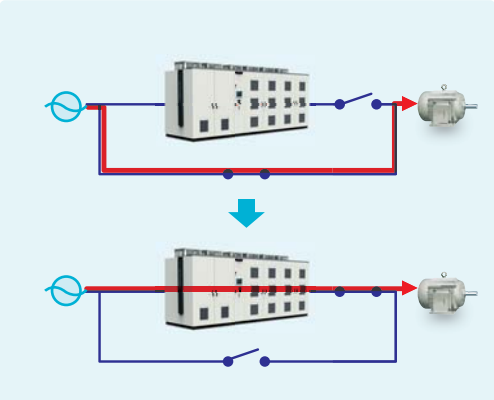
- Switching motor power from medium voltage drive to commercial power (bypass mode) or vice versa (drive mode)
- Synchronous transfer function performs synchronization of the phases of two power sources while motor is running, enabling power transfer and prevention of ensuing over-current

- Short up/down transfer time
- Ensuring reliability with over-current

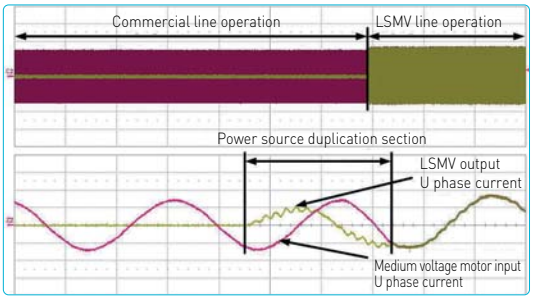


Inv mode ⟶ Grid mode(Up)


LSMV line operation
Commercial line operation
Power source duplication section
LSMV output U phase current
Medium Voltage Motor Input U Phase Current



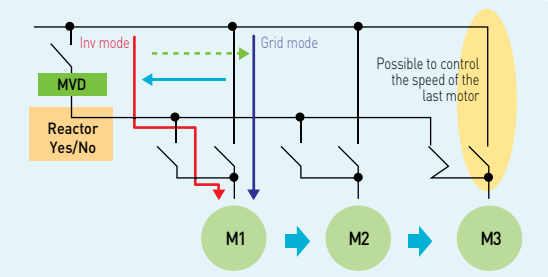
Grid mode ⟶ Inv mode(Down)


Commercial line operation
LSMV line operation
Power source duplication section
LSMV output U phase current
Medium voltage motor input U phase current

Multi Motor Transfer

Multi-motor synchronous transfer function allows users to start multiple (up to 3) MV motors sequentially in drive mode and control the last motor speed

1. Start M1 motor in Inv Mode and transfer it to Grid Mode
2. Start M2 motor in Inv Mode and transfer it to Grid Mode
3. Start M1 motor in Inv Mode to control speed



Note) Delivering uninterrupted motor current requires reactor option.

LSMV-M1000/M1000A Series*!*

Next Generation Motor Drive Solutions Enabling Energy Saving in Various Industrial Domains*!*

Multi-winding Phase-shift Transformer

- Multi-winding phase-shift transformer (36 pulse/18 winding) is in place with taps for change in input voltage.
- Reducing power harmonics with multi-pulse filtering in compliance with IEEE standards
- Eliminating need for harmonic filter and power factor-improving condenser

Master Control Module

- Master control module to control multi-level PWM output voltage with a total of 18 unit cells and fiber optic communication link.
- User-centric system view to support system diagnostics and monitoring

Cell Drive Module

- Six low-voltage single-phase drives in serial connection per phase, generating 25 level 3 phase output voltage. It is designed to ensure easy cell maintenance.
- Each cell performs PWM switching in distributed control mode and has default built-in cell protection and bypass functions.

DESIGN

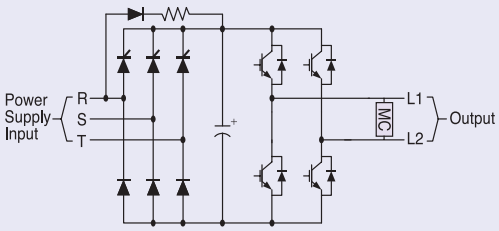
Power Cell

- Cell-specific keypad allows users to check individual cell details
- Additional R/S/T and P/N check PIN allows for safe cell state monitoring

Cable Type Cell

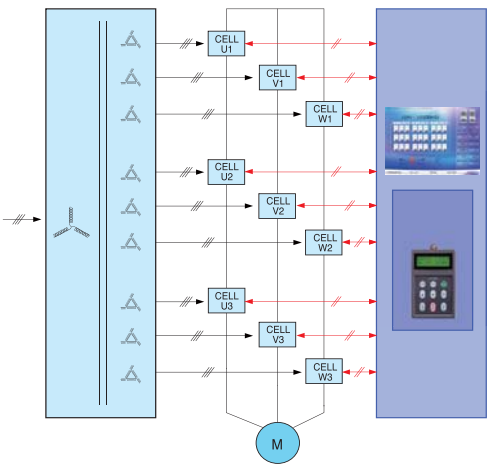
1. Fiber Optic Board (Cell side)
2. Output Terminal (T1, T2)
3. AC630V, Input Terminal (L1, L2, L3)
4. Fiber Optic Board (Control panel side)

Bus Type Cell

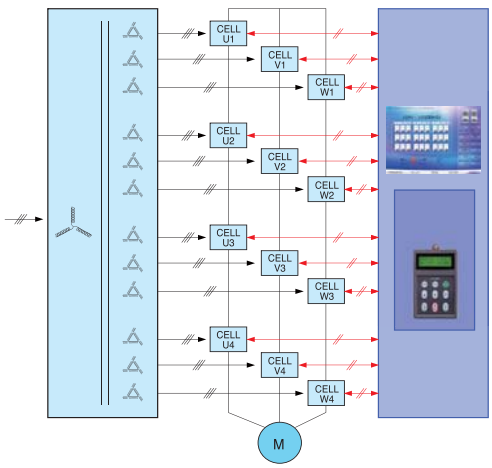


System Circuit Diagram

3kV Class

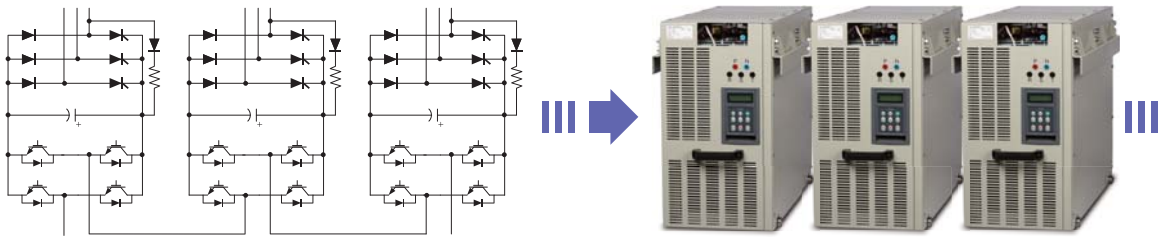


4kV Class

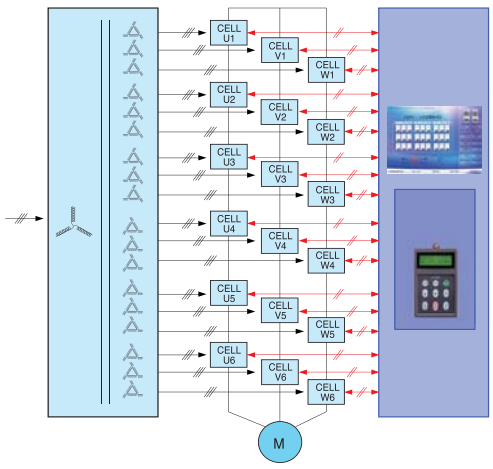


Cascaded H-bridge Multi-level Drive

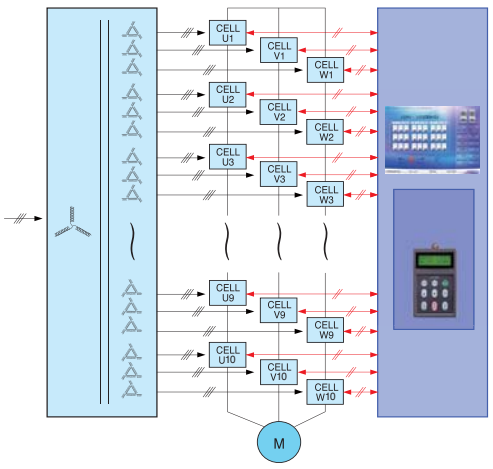
- Adopting multi-winding phase-shift transformer lowers input THD (Eliminating the need for input filters)
- Multiple voltage steps allow lower output THD (Eliminating the need for output filters)
- Reducing common mode voltage and leakage current (Effective to extend motor service life)
- Enabling complete modularization of power module circuits
- Modular design makes easy voltage increase
- Continuous operation possible through individual power cell failure
- Minimal impact of voltage reflection allows for longer cable distance between drive and motor



6kV Class



10kV Class



SELECTION AND ORDERING DATA

User-centric Customized Solutions

With its proven reliability and perfect green energy solution,
LSIS MV Drive fully satisfies the needs of each and every customer.

Ordering Data

Model Number

LSMV M□□□□-□□□ □□□ □□□-□□□

LSIS Medium Voltage Drive

Series
- 1000
- 1000A

Input Voltage
- 030 : 3.0[kV]
- 033 : 3.3[kV]
- 041 : 4.16[kV]
- 060 : 6.0[kV]
- 066 : 6.6[kV]
- 100 : 10.0[kV]
- 110 : 11.0[kV]

Input Frequency
- F : 50[Hz]
- S : 60[Hz]

Output Voltage
- 030 : 3.0[kV]
- 033 : 3.3[kV]
- 041 : 4.16[kV]
- 060 : 6.0[kV]
- 066 : 6.6[kV]
- 100 : 10.0[kV]
- 110 : 11.0[kV]

Total Capacity

200 : 200[kVA]	250 : 250[kVA]
300 : 300[kVA]	400 : 400[kVA]
500 : 500[kVA]	600 : 600[kVA]
700 : 700[kVA]	800 : 800[kVA]
10H : 1000[kVA]	13H : 1250[kVA]
15H : 1500[kVA]	16H : 1600[kVA]
18H : 1750[kVA]	20H : 2000[kVA]
24H : 2400[kVA]	25H : 2500[kVA]
30H : 3000[kVA]	33H : 3300[kVA]
35H : 3500[kVA]	40H : 4000[kVA]
41H : 4100[kVA]	45H : 4500[kVA]
49H : 4900[kVA]	50H : 5000[kVA]
55H : 5500[kVA]	60H : 6000[kVA]
66H : 6600[kVA]	70H : 7000[kVA]
75H : 7500[kVA]	80H : 8000[kVA]
83H : 8300[kVA]	90H : 9000[kVA]
95H : 9500[kVA]	10M : 10000[kVA]
11M : 11000[kVA]	13M : 12500[kVA]

Customizing
- S : Standard Spec.
- C : Customizing Spec.

Operating Mode
- S : Single Drive
- M : Multi Drive

Synchronous Transfer
- N : Synchronous transfer X
- Y : Synchronous transfer O

Capacity Line-up by Voltage

Classification	MV VFD Capacity												
3kV Class	200	300	400	500	600	750	1000	1200	1500	2000	2500	3000	3700
4kV Class	250	380	500	630	750	950	1200	1500	1900	2500	3100	3700	4700
6kV Class	400	600	800	1000	1200	1500	2000	2500	3000	4000	5000	6000	7500
10kV Class	600	900	1200	1500	1800	2200	3000	3700	4500	6000	7500	9000	11000
11kV Class	660	1000	1300	1600	2000	2400	3300	4100	4900	6600	8300	10000	12500

※ Call us for details
※ Call our sales representatives in advance as LSMV-M1000A has capacity restrictions.

SELECTION AND ORDERING DATA

Standard Specifications

Item		Standard Rating												
3kV Class	LSMVM□□□□-03□S■■■ 60Hz	200	300	400	500	600	750	10H	12H	15H	20H	25H	30H	37H
	LSMVM□□□□-03□F■■■ 50Hz	200	300	400	500	600	750	10H	12H	15H	20H	25H	30H	37H
	Output Capacity(kVA)	200	300	400	500	600	750	1000	1200	1500	2000	2500	3000	3700
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW)	160	250	330	410	500	620	850	1000	1250	1700	2080	2500	3150
4kV Class	LSMVM□□□□-041□F■■■ 50Hz	250	380	500	630	750	950	12H	15H	19H	25H	31H	37H	47H
	Output Capacity(kVA)	250	380	500	630	750	950	1200	1500	1900	2500	3100	3700	4700
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW)	200	310	410	530	620	790	1000	1250	1580	2080	2650	3150	4000
6kV Class	LSMVM□□□□-06□S■■■ 60Hz	400	600	800	10H	12H	15H	20H	25H	30H	40H	50H	60H	75H
	LSMVM□□□□-06□F■■■ 50Hz	400	600	800	10H	12H	15H	20H	25H	30H	40H	50H	60H	75H
	Output Capacity(kVA)	400	600	800	1000	1200	1500	2000	2500	3000	4000	5000	6000	7500
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW)	330	500	660	850	1000	1250	1700	2080	2500	3400	4100	5000	6200
10kV Class	LSMVM□□□□-100F■■■ 50 Hz	600	900	12H	15H	18H	22H	30H	37H	45H	60H	75H	90H	11M
	Output Capacity(kVA)	600	900	1200	1500	1800	2200	3000	3700	4500	6000	7500	9000	11000
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW)	500	750	1000	1250	1500	1800	2500	3150	3800	5000	6200	7200	9300
11kV Class	LSMVM□□□□-110S■■■ 60 Hz	660	10H	13H	16H	20H	24H	33H	41H	49H	66H	83H	10M	13M
	LSMVM□□□□-110F■■■ 50 Hz	660	10H	13H	16H	20H	24H	33H	41H	49H	66H	83H	10M	13M
	Output Capacity(kVA)	660	1000	1300	1600	2000	2400	3300	4100	4900	6600	8300	10000	12500
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW)	550	800	1000	1300	1600	1900	2700	3400	4100	5500	6800	8000	10500
Power Factor		About 95% (at rated speed and load conditions)												
Efficiency		About 97% (at rated speed and load conditions)												
Input Current THD		Satisfies IEEE standard 519-1992												
Input	Main Circuit	3 phase 3 kV/3.3 kV/4.16 kV/6 kV/6.6 kV/10 kV ±10%, 50/60 Hz *Note1)												
	Control Circuit	3 phase 220 V/380 V/440 V ±10%, 50/60 Hz ±5%												
Output	Rated Voltage	3 phase 3 kV/3.3 kV/4.16 kV/6 kV/6.6 kV/10 kV Max. 37 level												
	Output Frequency	0 ~ 120 Hz												
Control	Overload Resistance	60 seconds at 120% (at normal duty)												
Operation	System Monitoring	HMI : XP-80 (default)												
Signal in/Output	PLC	XGK input: 32 channels, output: 32 channels												
Protection Features		Over-current, Drive overload, Output cable earth fault, Electronic thermal, Output cable opening output cable open phase, Input over-voltage, Input under-voltage, Input cable open phase, Cell DC over-voltage, Cell overheating, Transformer overheating and etc.												
Communication Function		RS-485 built in, optional: DeviceNet, Profibus, Modbus-RTU, Modbus/TCP, Ethernet/IP												
Architecture	Protection	IP21 (default)~IP42 (option)												
	Cell Bypass	Built-in default (manual/auto bypass)												
Installation Environment	Cooling Mode	Air cooling												
	Ambient Temperature	0~40℃												
	Humidity	Max. 85% (No Condensation)												
	Altitude	1,000m or below												
	Installation	Installation: indoor *Note3)												
Input Transformer		Class H, air cooling, N/+5%/10% or -5%/N/+5%												

* Note 1) Call us for other voltage specifications. *Note 2) MV system view is an option. *Note 3) Install the HVAC system as well when installing the product herein.
* Call our sales representative in advance as LSMV-M1000A has capacity restrictions.

Options

Type		Function
Local Drive	Additional Local Drive Box	RUN/STOP Input : Current/Voltage speed reference Monitoring(Meter) : Current, RPM Switch : Emergency stop
Communication Card	RS-485	
	Modbus RTU	
	Profibus	
	Device NET	
	Metasys N2	
PLC Function	Analogue Input	No. of input channels (max. 16 channels per slot)
		Voltage input(DC 1~5V, DC 0~5V, DC 0~10V, DC -10~10V)
		Current input(DC 4~20mA, DC 0~20mA)
		Select range (select in PLC program)
		Resolution(1/16,000)
	Analogue Output	No. of output channels (max. 8 channels per slot)
		Voltage output(DC 1~5V, DC 0~5V, DC 0~10V, DC -10~10V)
		Current output(DC 4~20mA, DC 0~20mA)
		Select range (select in PLC program)
		Resolution(1/16,000)
	Digital Input	No. of input channels (max. 16 channels per slot)
		Rated input voltage(DC 24V)
		Rated input current(4mA)
		Common (Com) mode (16 points/1COM)
		Insulation mode (photocoupler)
	Digital Output	No. of output channels (max. 16 channels per slot)
		Rated input voltage(DC12/24, AC110/220V)
		Rated input current (1 point: 2A, Common: 5A)
		Common (Com) mode (16 points/1COM)
		Insulation mode (relay)
	Thermoresistor Input	No. of input channels (max. 4 channels per slot)
		Input sensor type(PT100, JPT100)
		Input temperature range(PT100 : -200 ~ 850℃, JPT100 : -200 ~ 640℃)
		Precision(room temperature[25℃]:±0.2% within, full range[0~55℃]:±0.3% within)

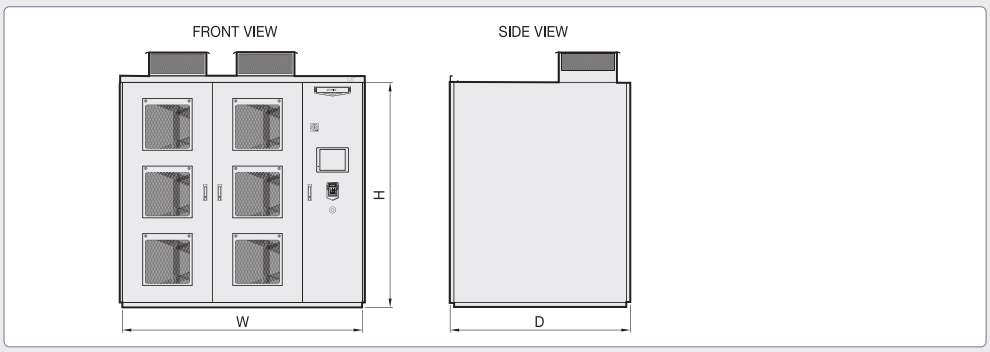
Note 1) Can select up to 4 options among the following PLC options
Ex) 2 additional analogue inputs, 1 additional digital input, 1 additional thermoresistor input

Note 2) As synchronous transfer function uses 2 PLC slots, reducing available options to 2,
be sure to call our sales representative if you need PLC extension base.

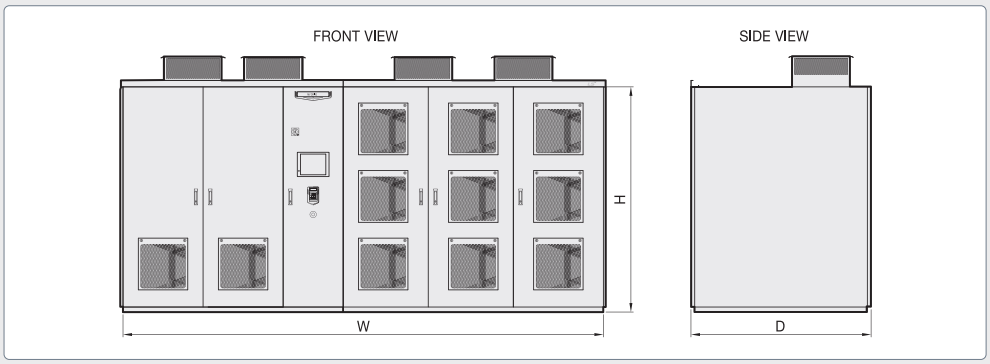
TECHNICAL DATA

Schematic Drawing of LSMV-M1000

A Type



B Type



Dimension and Weight

Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity [kW] 1)	Panel Size[mm] 2)			Approximate Weight [kg]	Panel Type
						Width	Depth	Height		
3000	50/60	180	35	LSMVM1000-030□030200	140	1600	1800	2250	2504	A
		270	53	LSMVM1000-030□030300	210	1600	1800	2250	2629	A
		360	70	LSMVM1000-030□030400	290	1600	1800	2250	2808	A
		450	88	LSMVM1000-030□030500	360	1700	1800	2250	3112	A
		540	105	LSMVM1000-030□030600	440	1700	1800	2250	3247	A
		680	131	LSMVM1000-030□030750	550	3600	1800	2250	4806	B
		900	175	LSMVM1000-030□03010H	730	3600	1800	2250	5285	B
		1100	218	LSMVM1000-030□03012H	910	3600	1800	2250	5670	B
		1360	260	LSMVM1000-030□03015H	1120	3600	1800	2250	5933	B
		1810	350	LSMVM1000-030□03020H	1500	4400	1900	2350	8073	B
		2270	438	LSMVM1000-030□03025H	1880	4400	1900	2350	8747	B
		2720	525	LSMVM1000-030□03030H	2250	4700	2200	2650	5569	B
		3360	657	LSMVM1000-030□03037H	2780	4700	2200	2650	5648	B
3300	50/60	200	35	LSMVM1000-033□033200	160	1600	1800	2250	2504	A
		300	53	LSMVM1000-033□033300	240	1600	1800	2250	2629	A
		400	70	LSMVM1000-033□033400	320	1600	1800	2250	2808	A
		500	88	LSMVM1000-033□033500	400	1700	1800	2250	3112	A
		600	105	LSMVM1000-033□033600	490	1700	1800	2250	3247	A
		750	131	LSMVM1000-033□033750	610	3600	1800	2250	4806	B
		1000	175	LSMVM1000-033□03310H	820	3600	1800	2250	5285	B
		1200	218	LSMVM1000-033□03312H	990	3600	1800	2250	5670	B
		1500	260	LSMVM1000-033□03315H	1240	3600	1800	2250	5933	B
		2000	350	LSMVM1000-033□03320H	1660	4400	1900	2350	8073	B
		2500	438	LSMVM1000-033□03325H	2070	4400	1900	2350	8747	B
		3000	525	LSMVM1000-033□03330H	2490	4700	2200	2650	5569	B
		3700	657	LSMVM1000-033□03337H	3070	4700	2200	2650	5648	B

Dimension and Weight

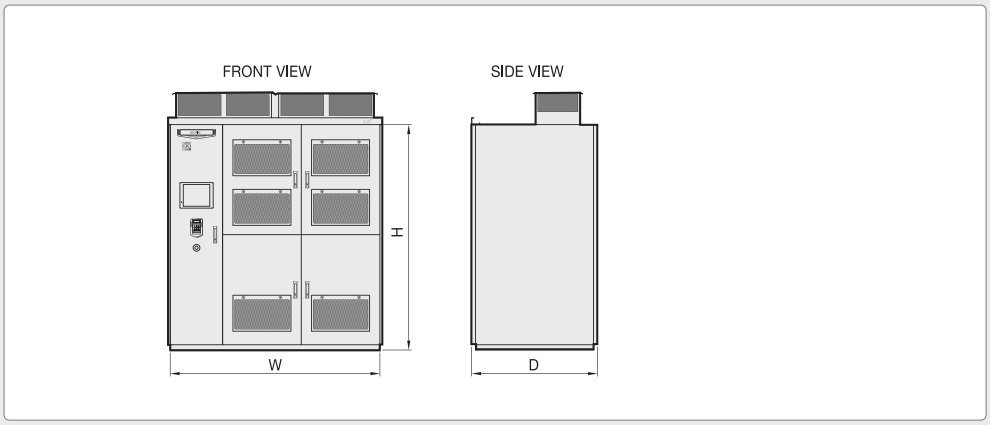
Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity[kW] 1)	Panel Size[mm] 2)			Approximate Weight [kg]	Panel Type
						Width	Depth	Height		
4160	50/60	250	35	LSMVM1000-041□041250	200	2000	1800	2250	3121	A
		380	53	LSMVM1000-041□041380	300	2000	1800	2250	3351	A
		500	70	LSMVM1000-041□041500	400	2000	1800	2250	3615	A
		630	88	LSMVM1000-041□041630	510	2000	1800	2250	3873	A
		750	105	LSMVM1000-041□041750	610	2000	1800	2250	4124	A
		950	131	LSMVM1000-041□041950	770	4000	1800	2250	6051	B
		1200	175	LSMVM1000-041□04112H	980	4000	1800	2250	6401	B
		1500	218	LSMVM1000-041□04115H	1240	4000	1800	2250	6909	B
		1900	260	LSMVM1000-041□04119H	1570	4000	1800	2250	7430	B
		2500	350	LSMVM1000-041□04125H	2070	5000	1900	2350	9870	B
		3100	438	LSMVM1000-041□04131H	2570	5000	1900	2350	10622	B
		3700	525	LSMVM1000-041□04137H	3070	5500	2200	2650	12861	B
		4700	657	LSMVM1000-041□04147H	3900	5500	2200	2650	14681	B
6000	50/60	360	35	LSMVM1000-060□060400	280	2400	1800	2250	3589	A
		540	53	LSMVM1000-060□060600	430	2400	1800	2250	4019	A
		720	70	LSMVM1000-060□060800	580	2400	1800	2250	4463	A
		900	88	LSMVM1000-060□06010H	720	2400	1800	2250	4752	A
		1090	105	LSMVM1000-060□06012H	890	2400	1900	2250	5110	A
		1360	131	LSMVM1000-060□06015H	1110	4800	1900	2250	7959	B
		1800	175	LSMVM1000-060□06020H	1470	4800	1900	2250	8652	B
		2200	218	LSMVM1000-060□06025H	1820	4800	1900	2250	9317	B
		2720	260	LSMVM1000-060□06030H	2250	4800	1900	2250	10091	B
		3630	350	LSMVM1000-060□06040H	3010	6400	1900	2350	13718	B
		4540	438	LSMVM1000-060□06050H	3760	6400	1900	2350	15057	B
		5450	525	LSMVM1000-060□06060H	4520	6900	2200	3250	18766	B
		6810	657	LSMVM1000-060□06075H	5650	6900	2200	3250	21456	B
6600	50/60	400	35	LSMVM1000-066□066400	320	2400	1800	2250	3589	A
		600	53	LSMVM1000-066□066600	480	2400	1800	2250	4019	A
		800	70	LSMVM1000-066□066800	640	2400	1800	2250	4463	A
		1000	88	LSMVM1000-066□06610H	810	2400	1800	2250	4752	A
		1200	105	LSMVM1000-066□06612H	980	2400	1900	2250	5110	A
		1500	131	LSMVM1000-066□06615H	1230	4800	1900	2250	7959	B
		2000	175	LSMVM1000-066□06620H	1640	4800	1900	2250	8652	B
		2500	218	LSMVM1000-066□06625H	2070	4800	1900	2250	9317	B
		3000	260	LSMVM1000-066□06630H	2490	4800	1900	2250	10091	B
		4000	350	LSMVM1000-066□06640H	3320	6400	1900	2350	13718	B
		5000	438	LSMVM1000-066□06650H	4150	6400	1900	2350	15057	B
		6000	525	LSMVM1000-066□06660H	4980	6900	2200	3250	18766	B
		7500	657	LSMVM1000-066□06675H	6220	6900	2200	3250	21456	B
10000	50/60	600	35	LSMVM1000-100□100600	480	Note 1)				
		900	53	LSMVM1000-100□100900	720					
		1200	70	LSMVM1000-100□10012H	970					
		1500	88	LSMVM1000-100□10015H	1210					
		1800	105	LSMVM1000-100□10018H	1470					
		2200	131	LSMVM1000-100□10022H	1800					
		3000	175	LSMVM1000-100□10030H	2460					
		3700	218	LSMVM1000-100□10037H	3070					
		4500	260	LSMVM1000-100□10045H	3730					
		6000	350	LSMVM1000-100□10060H	4980					
		7500	438	LSMVM1000-100□10075H	6220					
		9000	525	LSMVM1000-100□10090H	7470					
		11000	657	LSMVM1000-100□10011M	9130					

Note 1) Call our sales representative for the dimension of 10kV/11kV class products.

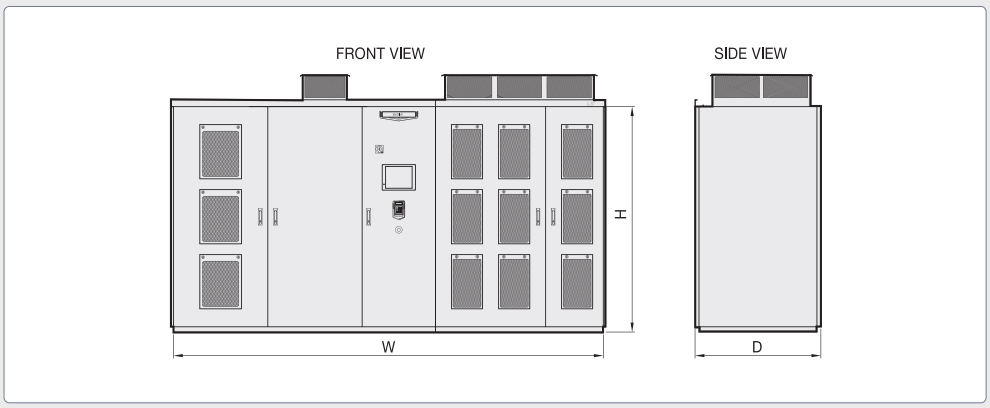
TECHNICAL DATA

Schematic Drawing of LSMV-M1000A

C Type



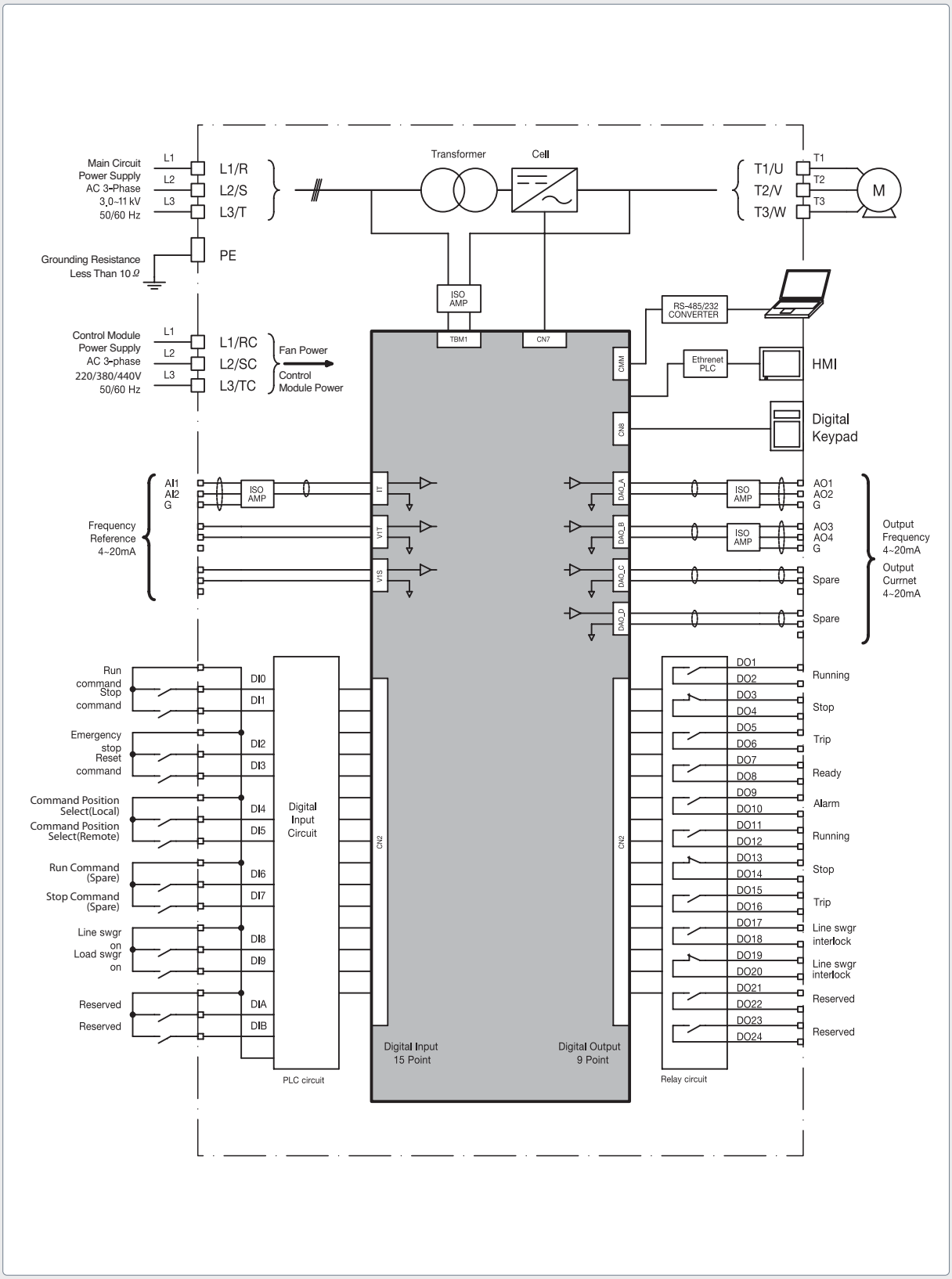
D Type



Dimension and Weight

Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity[kW] 1)	Panel Size[mm] 2)			Approximate Weight [kg]	Panel Type
						Width	Depth	Height		
3000	50/60	180	35	LSMVM1000A-030□030200	140	2000	1200	2150	2036	C
		270	53	LSMVM1000A-030□030300	210	2000	1200	2150	2276	C
		360	70	LSMVM1000A-030□030400	290	2000	1200	2150	2466	C
		450	88	LSMVM1000A-030□030500	360	2000	1200	2150	2636	C
		540	105	LSMVM1000A-030□030600	440	2000	1200	2150	2766	C
3300	50/60	200	35	LSMVM1000A-033□033200	160	2000	1200	2150	2036	C
		300	53	LSMVM1000A-033□033300	240	2000	1200	2150	2276	C
		400	70	LSMVM1000A-033□033400	320	2000	1200	2150	2466	C
		500	88	LSMVM1000A-033□033500	400	2000	1200	2150	2636	C
		600	105	LSMVM1000A-033□033600	490	2000	1200	2150	2766	C
6000	50/60	360	35	LSMVM1000A-060□060400	280	4100	1200	2150	3574	D
		540	53	LSMVM1000A-060□060600	430	4100	1200	2150	3844	D
		720	70	LSMVM1000A-060□060800	580	4100	1200	2150	4284	D
		900	88	LSMVM1000A-060□06010H	720	4100	1200	2150	4674	D
		1090	105	LSMVM1000A-060□06012H	890	4100	1200	2150	4874	D
6600	50/60	400	35	LSMVM1000A-066□066400	320	4100	1200	2150	3574	D
		600	53	LSMVM1000A-066□066600	480	4100	1200	2150	3844	D
		800	70	LSMVM1000A-066□066800	640	4100	1200	2150	4284	D
		1000	88	LSMVM1000A-066□06610H	810	4100	1200	2150	4674	D
		1200	105	LSMVM1000A-066□06612H	980	4100	1200	2150	4874	D

Standard Connection Diagram



TECHNICAL DATA

Circuit Terminals

Number	Application
L1(R)	Main circuit input voltage rating 3kV/3.3kV/4.16kV/6kV/6.6kV/10kV/11kV,±10%(TAP "0" in the),50/60Hz
L2(S)	
L3(T)	
U	Main circuit output voltage 3kV/3.3kV/4.16kV/6kV/6.6kV/10kV/11kV,0~120Hz
V	
W	
Ground	Grounding resistance: 〈 Less than 10 Ω
L1(RC)	2 Phase, 220V Control power 3 Phase, 220V, 380V, 440V 50Hz or 60Hz (Voltage : ±10%, Frequency : ±5%,)
L2(SC)	
L3(TC)	

Control Circuit

Type	Terminal No.	Signal Name	Functional Description	Function
Analogue Input	AI1	Freq Reference	Operating command input	User Selection (DC 0~10V or 4~20mA
	AI2			
Analogue Output	A01	Output Speed	Feedback operating speed feedback	User Selection (DC 0~10V or 4~20mA) Spare 2 Signal
	A02			
	A03	Output Current	Feedback output current feedback	
	A04			
	A05	Output Speed	Reserve	
	A06			
	A07	Output Current	Reserve	
	A08			
Digital Input	DI0	Rst	Reset	FX/RX/RST/JOG/BX/Speed-L/ Speed-M/Speed-H/Speed-X/Xcel-L/ Xcel-M/Xcel-H/Up/Down/3-Wire/ Analog hold/Ana. Change/Xcel stop/Loc/ Rem/Door Open/Trans.OHW/Trans.OHT/ Motor OHT/Fan Trip/Ext Trip1/Ext Trip2/ Medium Voltage/Run Enable/ Control LV/PLC_Error/None
	DI1	Ext Trip	External failure	
	DI2	Fx	Normal direction operation	
	DI3	Rx	Reverse direction operation	
	DI4	Trans. OHT	Transformer overheating	
	DI5	Fan Trip	Fan failure	
	DI6	Medium Voltage	Apply input power	
	DI7	Run Enable	Operation possible	
	DI8	Control LV	Control power loss	
	DI9	Reserve	-	
	DI10	Reserve	-	
	DI11	Reserve	-	
	DI12	Reserve	-	
	DI13	Reserve	-	
	DI14	BX	Emergency stop	
Digital Output	AXA1	Ready	Control power read	None/FDT-1/FDT-2/FDT-3/FDT-4/FDT-5/OL/IOL/Stall/OV/LV/OH/Lost Command/Run/Stop/Steady/Speed Search/Ready/Warning/FAN RUN/NORMAL/OCT/Cell_ByPass/RUN_MV
	AXA2	FAN RUN	Fan operation command	
	AXA3	RUN	MVD in operation	
	AXA4	Warning	MVD warning	
	AXA5	Reserve	-	
	AXA6	Reserve	-	
	AXA7	Reserve	-	
	AXA8	Reserve	-	
	30ACB	TRIP	MVD failure	

Protective Function

Individual Cell Production Function

Protection Function	Description
Over Current	It occurs when cell output current is at or over a standard level.
Over Voltage	If the main circuit DC voltage rises over a standard level due to regenerative energy from motor braking or generation load or power system voltage surges and over voltage trip occurs, it cuts off power to drive and stop free run.
Arm Short	It occurs when the IGBT arm or output short circuits. Drive output is cut off and free run stopped in case of arm short circuit
Communication Error	It occurs if there is a communication problem between the cell and master.
Cell Overheat	It occurs if the internal heatsink's cell temperature rises over a standard level.
Ntc Open	It occurs when cell's internal temperature sensor fails and there is a problem in temperature measurement.
Low Voltage	It occurs when the main circuit DC voltage falls below a standard level.

System Protection Function

Protection Function	Description
Over Current	If the output current of MV drive reaches 140% or more of rated current, output is cut off and free run stopped.
MVD Over Load	If the output current of the MV drive reaches 120% or more of the rated current and stays at that level for 1 minute or longer, output is cut off and free run stopped.
Ground Fault	If phase imbalance of output current occurs at or above a standard level following a grounding fault of the output cable of MV drive, output is cut off and free run stopped.
Motor Over Load	If the MV drive output current exceeds OL level and the OL time set for the rated motor current, output is cut off and free run stopped.
E-thermal	If the motor is deemed to be overheated at or above a standard level based on the theoretical calculation of motor temperature rise (based on MV drive output frequency and output current), output is cut off and free run stopped.
Low Current (No Motor Trip)	It occurs when it is deemed that the motor connection is broken due to switch gear failure on the output side while the MV drive is operating or starting, output is cut off and free run stopped.
Output Phase Open	It is a function to protect the MV drive from open phase of the output cable during operation.
Input Phase Open	It is a function to protect the MV drive from open phase of the input cable during operation
Input Over Voltage	It occurs when the main transformer input voltage reaches 120% or more of the MV drive rated voltage and cuts off output.
Input Low Voltage	It occurs when the main transformer input voltage reaches 70% or less of the MV drive rated voltage and cuts off output.
DC Over Voltage	If DC voltage of any of the cells used in the MV drive exceeds 1050V, output is cut off.
Cell Overheat	If any of the cells reaches 75℃ or more, it is regarded as failure and output is cut off.
Trans Overheat	If the main transformer temperature reaches 120℃ or more, failure is detected through the multi-function digital input.
BX	It is a fault used for the MV drive emergency stop. Power is cut off at user's decision when an emergency occurs and signal is received through switch or external signal link.
Motor Overheat	If trip signal of motor temperature sensor is received through digital input, output is cut off.
Fan Error	If a fan installed on the top to cool the MV drive fails and signal is received through the digital input, output is cutoff.
Ext Trip1, Ext Trip2	Contacts can be configured as faults in accordance with fault stop and sequence setup configured by users to handle specific events other than tripping.
Control Low Voltage	It occurs when power is not supplied following a problem in the MV drive control power and output is cutoff.
PLC Error	If a problem occurs in the PLC installed within the MV drive and PLC failure contact is received from the digital input, output is cutoff.
Can Error	It is a protection function that activates if there is a communication problem between the MV drive controller and cell. It is interlinked with the cell bypass operation as configured.
Cell Trip	It is a protection function that allows the master to trip cells where faults have occurred.

APPENDIX

Installation

Installation Environment

M-series products should be installed in an environment where the following conditions are met:

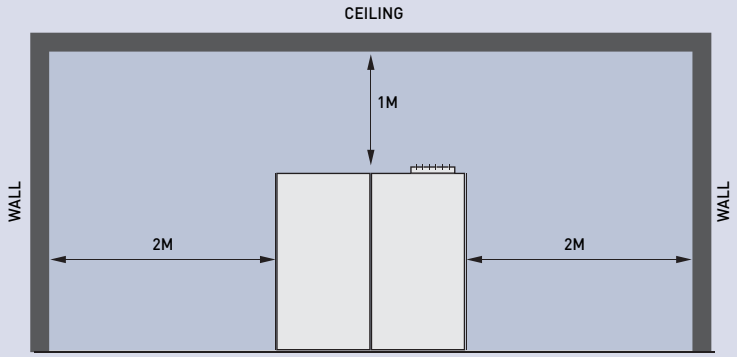
- Ambient temperature : 0 ~ 40℃
- Ambient humidity : 85% or less (no dew formation)
- No water dropping from above
- No direct exposure to dust
- No existence of corrosive liquid or gas
- Absence of excessive vibration

Space equal to the product footprint should be secured in advance in reference to applicable drawing when product is to be installed.

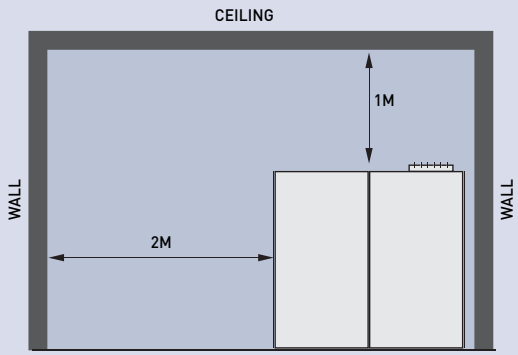
Installation Space

Sufficient space should be secured to cool down the product during the operation and facilitate maintenance.

LSMV-M1000



LSMV-M1000A



Ambient Temperature

This product should be installed at a location not exposed to severe environment changes in order to maintain product reliability. Temperature around the product and air allowed into the LSMV should be maintained at 40°... or below. When the product is installed in a confined place, an additional cooling fan or air conditioner should be installed to keep the room temperature at or below 40°

Blocking of Foreign Materials

Particular care should be taken to keep foreign materials such as dust or metal debris from finding their way into product while it is being installed. Extra care should be taken to keep foreign materials from flowing into the transformer. Do not leave installation tools or unused parts inside the panel after installation.

Maintenance

Daily & Regular Trouble Check

To prevent advance failure of the MV drive and ensure operational reliability over an extended period of time, check the product as described in the following table. Trouble checks include a daily check that can be performed during operation (Table 1) and regular checks that are performed when power is cutoff and operation has stopped (Table 2).

When performing a regular check, make sure that the keypad at the front of a cell is completely turned off to prevent damage from electric shocks.

Table 1 Daily Check Items

Check Location	Check Items	Check Description
System	Ambient Temperature	Check ambient temperature, humidity, dust, hazardous gas, oil leak, and the like
	System in General	Check abnormal vibration and noise
	Power Voltage	Check if the main circuit voltage and control voltage are normal
Main circuit	Transformer	Check for abnormal odor, sound, and noise
Cooling System	Cooling Fan	Check for abnormal vibration and noise
		Check and clean air filter
Display	Instrument	Check measurement accuracy and indicator reading

Table 2. Regular Check Items (Once / Year)

Check Location	Check Items	Check Description
Main Circuit	Transformer, Power Supply, Cell Panel	Check the insulation between the main circuit terminal and ground and between terminals with the insulation resistance meter
		Check if any screw, bolt, or connector is loose
		Check if any part is overheating
		Clean the inside of the panel
	Cable	Check for cable shield damage, deterioration
	Transformer	Check if the primary side voltage and secondary side voltage are normal
	Cell	Check for smoothing capacitor leaks
		Check if the smoothing capacitor is swollen
		Measure and check smoothing capacitor capacitance
		Check if any screw or bolt is loose
		Check if normal circuit and control circuit fuses are normal
		Clean dust built up inside product and heat sink
		Check if the protection circuit and indicator circuit operate as intended
Control Circuit	Operation	Check if the product operates as intended
	Relay	Check if the timer operates as intended
		Check if there is any damage to the contact.
		Check for abnormal odor and discoloring
	Board	Check power supply voltage
		Check for abnormal vibration and noise
Cooling System	Cooling Fan	Check operating direction

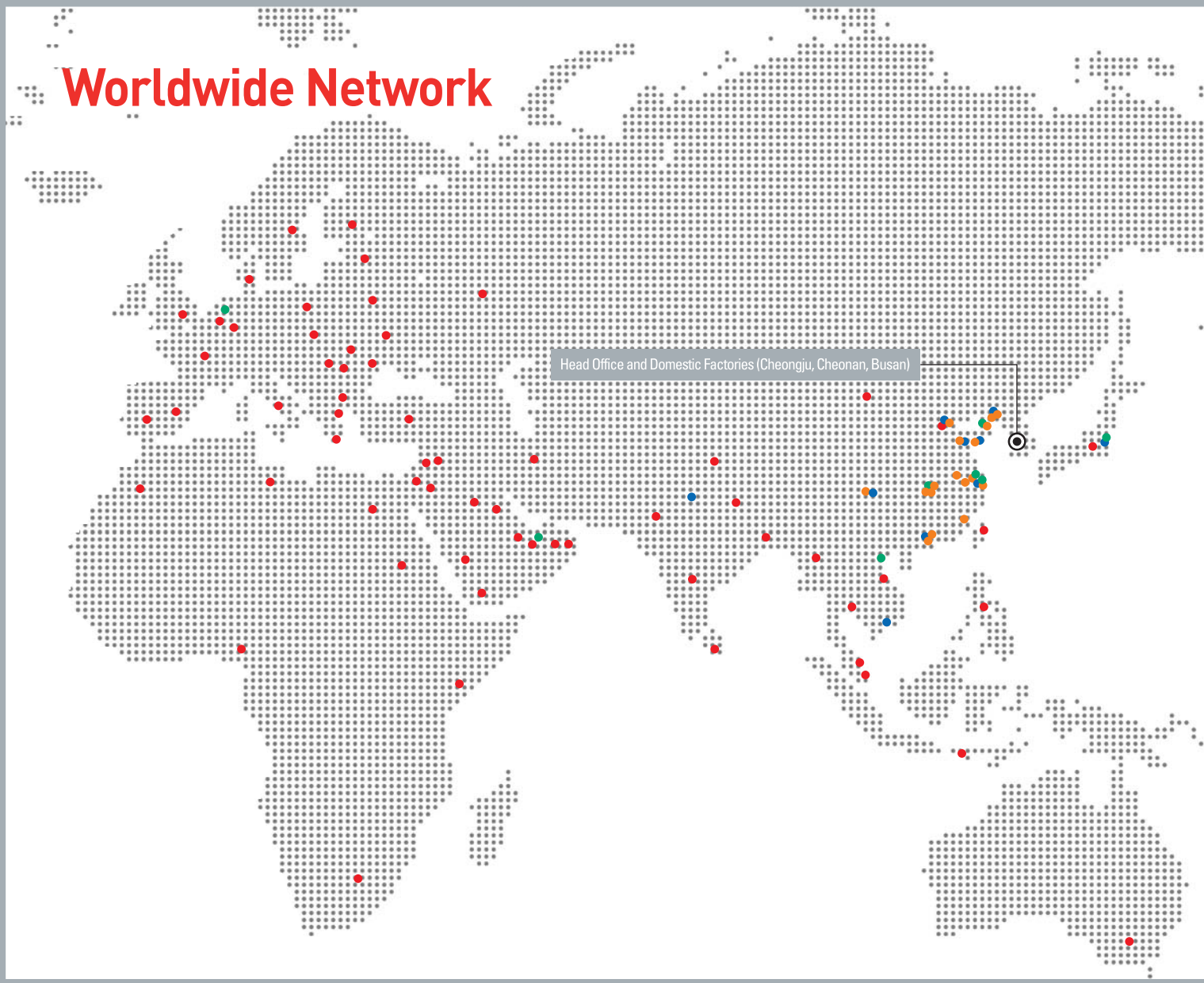
APPENDIX

Form for quotation

1	Name of Application	
2	Type of Load	☐ Pump ☐ Fan ☐ Blower ☐ Compressor ☐ Others
3	Torque Characteristics	☐ Variable Torque ☐ Proportional Torque ☐ Constant Torque ☐ Constant Output J(GD^2/4) kg·㎡
4	Operation Conditions	Motor Current_____A , Annual Operation Time_____hours
5	Motor Specifications	☐ Squirrel-Cage Induction motor ☐ Wound-Rotor Type Motor ☐ Existing ☐ New Output _____kW , Voltage_____V , Frequency _____Hz , Pole Number _____P Speed _____min , Rated Current ____A , Efficiency _____% , Power, Factor_____%
6	Speed Control Range	Minimum_____/min to Maximum_____/min or Minimum_____/Hz to Maximum_____/Hz
7	Acceleration/Deceleration Time Setting	Acceleration Time_____Second(s)/_____min Deceleration Time_____Second(s)/_____min
8	Overload Capacity	_____% /_____Second(s)
9	By-Pass Operation Circuit	☐ Required < ☐ Automatic ☐ Manual >
10	Power Supply Specifications	Main Circuit Voltage _____V , _____Hz Control Circuit Voltage ☐ 220V 3P ☐ 380V 3P ☐ 440V 3P ☐ Others _____V 3P
11	Ambient Conditions	Indoors ☐ Ambient Temperature _____℃, ☐ Humidity_____% or less ☐ Air-Conditioning Facility (☐ Provided ☐ Not Provided) ☐ Install Space (Width _____mm ☐ Height _____mm ☐ Depth _____mm) ☐ Cable Entry (☐ Bottom ☐ Top)
12	Option	

Energy Saving Drive Solution
LS Medium Voltage Drive
LSMV-M1000/M1000A

Worldwide Network



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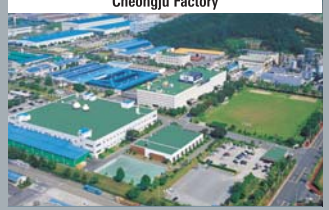

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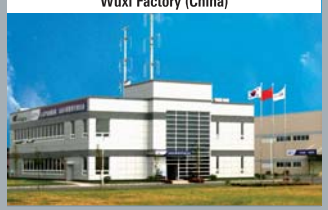

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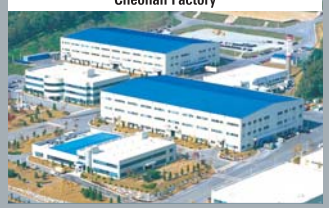

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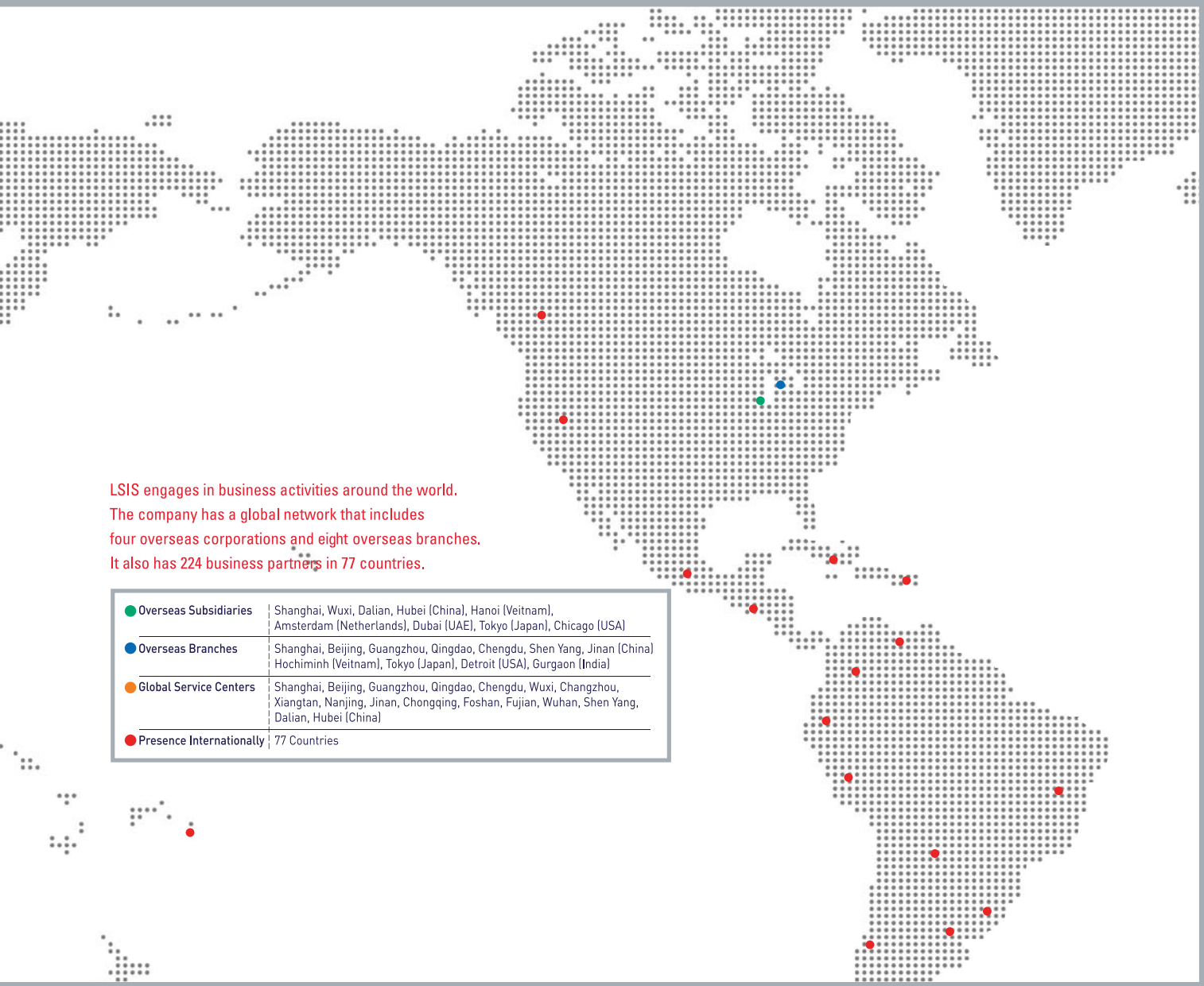

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Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

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